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EXAMINER

MURALIDAR, RICHARD V

ART UNIT

PAPER NUMBER

2838

DATE MAILED: 08/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/823,645	Applicant(s) OKAYAMA ET AL.	
	Examiner Richard V. Muralidar	Art Unit 2838	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 01 May 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-6 and 9-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-6, and 9-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) The invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 2-5, 9-14, 16, 18, 20, 21, and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Aiello et al [U.S. 6014323].

Claims 1, 7, and 8 [cancelled by applicant].

With respect to Claim 20 [New], Aiello discloses a power converter comprising: a plurality of interconnected power units [Fig. 3, switching cells A3, B3, and C3 form a power unit], mutually adjacent power units being sequentially cascaded in series with one another [Fig. 3, the power unit formed by A3, B3, and C3 is in series with the power unit formed by A2, B2, and C2; col. 4 lines 48-57], with one of said power units at a first end of a cascade connection being connected with a polyphase AC load [the power unit formed by A, B3, and C3 is connected to three phase motor load 44; col. 4 lines 33-34], another of said power units [Fig. 3, the combination of A1, B1, and C1] at a second end of the cascade connection being connected with a neutral point [the node shown at the bottom of Fig. 3, connected to A1, B1, and C1], each of said power units including an input transformer group [Fig. 3, transformers 41, 42, 43- col. 4 lines 35-40] including a single input transformer [41] having a primary winding connected to each of the phases of a first polyphase AC power supply [the primary winding of transformer 41 is

connected to the "a" phase, the "b" phase, and the "c" phase, through the primary winding of transformer 42] and a plurality of sets of secondary windings [Fig. 3, transformers 41, 42, and 43 each have 3 secondary windings], each set of secondary windings including windings equal in number to the phases of a polyphase AC load supplied with power by said power converter [Fig. 3, there are three windings per power unit, and three phases Va, Vb, and Vc shown for motor load 44], and a plurality of power cells equal in number to the number of phases of the polyphase AC load [Fig. 3, there are three power cells- A3, B3, and C3, one for each of the three phases Va, Vb, and Vc of the motor load 44], each power cell being connected to a respective set of said secondary windings of said input transformer group [as shown in Fig. 3], each power cell including a polyphase self-excited rectifier circuit [Fig. 1a switches 456-459; or Fig. 13, first switch set 201 to 206 are switched rectifiers, connected across 3 phases; Examiner notes that switched rectifiers and self-excited rectifiers are functionally equivalent] connected to the respective set of said secondary windings, a single-phase self-excited inverter circuit [Fig. 1a switches 456-459; or Fig. 13, switch set 209 to 212; Examiner notes that switched inverters and self-excited inverters are functionally equivalent], and a DC link circuit [Fig. 1a, capacitors 453a and b; alternatively, Fig. 13 clamp 207 functions as the DC link circuit] connecting said single-phase self-excited inverter circuit to said polyphase self-excited rectifier circuit to generate a single-phase power output [Fig. 13, a single phase output is shown going to the load from switch set 209 to 212], whereby electric power input from the first

polyphase AC power supply to said power units is output from said power cells to the polyphase AC load [as shown in Figs. 3, 8, and 11].

With respect to Claim 21 [New], Aiello discloses a power converter comprising: a plurality of interconnected power units [Fig. 3, switching cells A3, B3, and C3 form a power unit], mutually adjacent power units being sequentially cascaded in series with one another, with one of said power units at a first end of a cascade connection being connected with a polyphase AC load [Fig. 3, the power unit formed by A3, B3, and C3 is in series with the power unit formed by A2, B2, and C2; col. 4 lines 48-57], another of said power units [Fig. 3, the combination of A1, B1, and C1] at a second end of the cascade connection being connected with a neutral point [the node shown at the bottom of Fig. 3, connected to A1, B1, and C1], each of said power units including an input transformer group [Fig. 3, transformers 41, 42, 43- col. 4 lines 35-40] including transformers equal in number to the phases of the polyphase AC power supply [there are three transformers 41, 42, 43 which are supplied from three phases of the AC supply], each input transformer having a primary winding connected to each of the phases of the polyphase AC power supply [Fig. 3, transformer 41 has its primary connected to phase a, phase b, and phase c through primary winding 42] and a secondary winding having phases equal in number to the phases of a polyphase AC load supplied with power by said power converter [Fig. 3, the secondary winding of transformer 41 has three phases, one for each of the phases supplied by the converter to AC motor load 44], and a plurality of power cells equal in number to the number of phases of the polyphase AC load [there are three power cells A3, B3, and C3, one for

each of the three phases Va, Vb, and Vc of the AC motor load 44], each power cell being connected to said secondary windings of a respective one of said input transformers [Fig. 3, each of switching cells A3, B3 and C3 are connected to its own secondary winding], each power cell including a polyphase self-excited rectifier circuit [Fig. 1a rectifiers 451a-c and 452a-c; or Fig. 13, first switch set 201 to 206 are switched rectifiers, connected across 3 phases; Examiner notes that switched rectifiers and self-excited rectifiers are functionally equivalent] connected to said secondary windings of a respective one of said input transformers [Fig. 3, Fig. 7, Fig. 13- each switching cell containing a rectifier is connected to one of the secondary windings of transformer 41], a single-phase self-excited inverter circuit [Fig. 1a switches 456-459; or Fig. 13, switch set 209 to 212], and a DC link circuit [Fig. 1a, capacitors 453a and b; alternatively, Fig. 13 clamp 207 functions as the DC link circuit] connecting said single-phase self-excited inverter circuit to said polyphase self-excited rectifier circuit to generate a single-phase power output [Fig. 13, a single phase output is shown going to the load from switch set 209 to 212], whereby electric power input from the polyphase AC power supply to said power units is output from said power cells to the polyphase AC load [as shown in Figs. 3, 8, and 11].

Examiner notes that applicant's invention as well Aiello's invention both incorporates material from Hammond et al in [US 5625545] and [US 5986909]; and that the basic circuit topology is equivalently the same as disclosed by Hammond. Applicant's power unit is an integrated combination of the same input transformers coupled with the exact structure used for Hammond's power cell, which has three phase

diode rectifiers at the input and two phase switched inverters at the output, with a capacitor DC link circuit connecting the two. Applicant's phase module is exactly 1 leg of Hammond's power converter.

With respect to Claim 2, Aiello discloses that each of said polyphase self-excited rectifier circuits includes mutually parallel-connected phase modules corresponding in number to the number of phases of the first polyphase AC power supply, and each of said single-phase self-excited inverter circuit includes two phase modules [Fig. 3, switches 209 and 210 with their respective diodes form one phase module, and switches 211 and 212 with their respective diodes form the second phase module. This matches applicant's drawing in Fig. 5].

With respect to Claim 3, Aiello discloses each of said phase modules includes self-arc-extinguishing semiconductor devices [col. 6 lines 54-58; Examiner notes that any solid-state switch is implicitly arc-extinguishing, for example Aiello's IGBT's].

With respect to Claim 4, Aiello discloses each of said phase modules of said single-phase self-excited inverter circuits has a current rating greater than that of said phase modules of said polyphase self-excited rectifier circuits [Fig. 3, this is necessarily true since power taken from three rectifier phases A, B, and C, is routed through two inverter phases to the load].

With respect to Claim 5, Aiello discloses said DC link circuit includes a filter capacitor [Fig. 1a, capacitors 453a and b] having opposite terminals charged at different potentials, and said single-phase self-excited inverter circuit selectively [col. 3 lines 34-38] outputs one of the potentials in a single phase.

With respect to Claim 9, Aiello discloses that each of said input transformers [Fig. 1, transformer 2] includes a first set of secondary windings having a star connection and a second set of secondary windings having a delta connection [Fig. 1 secondary windings 6-8 are delta and Figs. 10E to 10H secondary windings are star], and each of said polyphase self-excited rectifier circuits of said power cells includes two polyphase diode rectifier circuits [Fig. 3, any two vertical legs of the rectifier portion of switches 451a - 452c] which are connected in parallel to said filter capacitors [as shown in Fig. 1a], respectively, of said DC link circuits [Fig. 1a capacitors 453a-b] and connected to said first set of said secondary windings having the star connection [Fig. 1, connections 3-5 or 9-11; or Fig. 10e to 10h star windings] and connected to said second set of secondary windings having the delta connection [Fig. 1, connections 6-8, or Fig. 10a to 10d delta connections], respectively.

With respect to Claim 10, Aiello discloses each set of secondary windings includes a group of secondary windings corresponding in number to the phases of the polyphase AC load, and having a star connection and a second group of secondary windings corresponding in number to the phases of the polyphase AC load and having a delta connection [Fig. 1 secondary windings 6-8 are delta and Figs. 10E to 10H secondary windings are star], and each of said polyphase self-excited rectifier circuits of said power cells includes two polyphase diode rectifier circuits which are connected in parallel [Fig. 1a 451a-c, and 452a-c] to said filter capacitors, respectively, of said DC link circuits [Fig. 1a capacitors 453a-b] and connected to said first group of said secondary windings having the star connection [Fig. 1, connections 3-5 or 9-11; or Fig.

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10e to 10h star windings] and connected to said set of secondary windings having the delta connection [Fig. 1, connections 6-8, or Fig. 10a to 10d delta connections], respectively.

With respect to Claim 11 and 12, Aiello discloses said at least one power unit has a passable input capacity different from that of others of said power units [Aiello's power cells are capable of this col. 3 lines 61-63; col. 8 lines 15-21. The controller commands that unit to turn on or off additional power cells 450 in Fig. 1a as needed. The power unit closest to the load (A3, B3, and C3) must be rated to handle its own power input and output, as well as the combined power inputs and outputs of any additional power units (A2, B2, and C2, as well as A1, B1, and C1) in series with it that may be turned on as needed].

With respect to Claim 16, Aiello discloses that each of said power cells includes a phase module [Fig. 13, any vertical leg of the rectifier or inverter stage is the same as applicant's phase module], and when an abnormality occurs in said phase module, said single phase self-excited inverter circuit forcibly fixes switching state of said phase module to inhibit an electric current from flowing into said filter capacitor of said DC link circuit [the switching and control circuitry is capable of this since the topology is the same as applicant's. Also see Hammond US 5986909 col. 2 lines 23-27; col. 4 lines 32-34].

With respect to Claims 18 and 24 [new], Aiello discloses said DC link circuit [Fig. 1a, capacitors 453a and b] includes a filter capacitor having opposite terminals charged at different potentials, each of the poly-phase self-excited rectifier circuit adjusts the

input power factor thereof so that the potential of the opposite terminals can be controlled [Fig. 1a is exactly the same as applicant's and can accomplish power factor control in a similar manner- col. 3 lines 34-38; col. 4 lines 35-40].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103[a] which forms the basis for all obviousness rejections set forth in this Office action:

[a] A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 13 and 14 are rejected under 35 U.S.C. 103[a] as being unpatentable over Aiello et al. [US 6014323].

With respect to Claim 13, Aiello discloses said power units [col. 2 lines 28-35 as many power cells can easily be integrated into a unit as desired] arranged at opposite ends of the cascade connection are connected with second and third, polyphase AC power supplies, so that electric power is input from the first polyphase AC power supply to said power units and output to the second and third polyphase AC power supplies [Fig. 3, each power cell draws power from one phase and returns it to another. Examiner notes that this is simply providing multiple 3 phase ac supplies, each with its own power converter comprising power units, power cells, etc., which effectively

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doubles the output capacity by placing another power converter with its own ac supply in series or parallel to the first power converter].

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine multiple power converters in series or parallel as desired, each with its own three phase power supply, for the benefit of increasing output power capacity to supply larger loads, more loads, or both.

With respect to Claim 14, Aiello discloses said plurality of power units [col. 2 lines 28-35 as many power cells can easily be integrated into a unit as desired] are divided into a plurality of groups of power units, and in each group of power units, mutually adjacent power units in each phase are sequentially cascaded in series with one another, and one of said power units at a first end of the cascade connection is connected to the polyphase AC load, and another one of said power units at a second end of the cascade connection is connected to said neutral point [see Figs. 3 and 11; this is a result of placing multiple power converters in series or parallel, each with their own ac 3 phase supply].

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine multiple power converters in series or parallel as desired, each with its own three phase power supply, for the benefit of increasing output power capacity to supply larger loads, more loads, or both.

Claims 6, 19, 22, and 25 are rejected under 35 U.S.C. 103[a] as being unpatentable over Aiello et al [US 6014323] in view of Salmon [US 5936855].

With respect to Claims 6 and 22 [new], Aiello discloses each of said DC link circuits includes filter capacitors connected in series with one another. However, Aiello does not disclose three capacitor terminals charged at different potentials [i.e. the 2 capacitors in series are center tapped and connected to the inverter stage via a center tap].

Salmon, discloses three capacitor terminals charged at different potentials and said single-phase self-excited inverter circuit selectively outputs one of the potentials in a single-phase potentials [i.e. the 2 capacitors in series are center tapped and connected to the inverter stage via a center tap- Figs. 1F, 4B, 4D, 5A, 5B, 6A, 13A; col. 10 lines 14-26].

Aiello and Salmon are analogous multiphase ac converters that reduce harmonic distortion. At the time of the invention it would have been obvious to one of ordinary skill in the art to add center tapped capacitors in the dc link circuit to Aiello for the purpose of providing a better harmonic correction function of line currents and also to lower line inductance [Salmon US 5936855 col. 10 lines 15-17].

With respect to Claims 19 and 25 [new], Aiello discloses each of said DC link circuits includes filter capacitors connected in series with one another, and each of said poly-phase self-excited rectifier circuits adjusts the input power factor thereof so that the potentials of the three terminals can be controlled [Fig. 1a is exactly the same as applicant's and can accomplish power factor control in a similar manner]. Aiello does not disclose that the capacitors have three terminals charged at different potentials [i.e. center tapped].

Salmon discloses that the capacitors in series are center tapped [Figs. 1F, 4B, 4D, 5A, 5B, 6A, 13A etc.; col. 10 lines 14-26. Examiner notes that center-tapped series capacitors used in this manner are common in the art- Geis et al (US 5903116) Fig. 4 provides another concrete example of this].

Aiello and Salmon are analogous multiphase ac converters that reduce harmonic distortion with motor loads. At the time of the invention it would have been obvious to one of ordinary skill in the art to add center tapped capacitors in the dc link circuit to Aiello for the purpose of providing a better harmonic correction function of line currents and also to lower line inductance [Salmon US 5936855 col. 10 lines 15-17].

Claims 15 and 23 are rejected under 35 U.S.C. 103[a] as being unpatentable over Aiello et al [US 6014323] in view of Nagashima et al [US 6219245].

With respect to Claims 15 and 23 [new], Aiello discloses each of said power cells includes a phase module [Fig. 1a any vertical leg of the rectifier or inverter stage], and a filter capacitor in said DC link circuit [Fig. 1a capacitors 453a and 453b] includes opposite terminals charged at different potentials, said phase module including a plurality of direct current buses [Fig. 1a bus 454 and 455] at different potentials, which are connected to said filter capacitor.

Aiello does not disclose a cooling header, arranged in parallel to said direct current buses for guiding a cooling medium to flow there through.

Nagashima discloses a cooling header [Abstract, Fig. 1], arranged in parallel to said direct current buses for guiding a cooling medium to flow there through [col. 1 lines 14-24 and 29-35].

Aiello and Nagashima are analogous uses of power converters to supply heavy loads, which results in undesired heating of the power converters due to switching and high current flow. At the time of the invention, it would have been obvious to one of ordinary skill in the art to add a cooling medium to Aiello for the purpose of reducing the heat output of the power converter due to switching and the heavy load presented by the 3-phase ac motor. It is well known that in high power applications power converters dissipate large amounts of heat that must be addressed if the surrounding circuitry is to survive/operate properly.

Claim 17 is rejected under 35 U.S.C. 103[a] as being unpatentable over Aiello et al [US 6014323] in view of Geis et al [US 5903116].

With respect to Claim 17, Aiello discloses the polyphase AC load comprises an electric motor for driving a compressor [col. 1 lines 10-24]. Aiello does not specify his AC supply is a turbogenerator [examiner notes that the ac supply could be anything suitable, be it a turbogenerator, diesel generator, or direct connection to the commercial grid].

Geis discloses said first polyphase AC power supply includes a turbogenerator [turbogenerator 10] group including a plurality of turbogenerators [as many

turbogenerators can be connected as desired in as many groups as desired to increase capacity].

Aiello and Geis are analogous ac motor controllers. At the time of the invention it would have been obvious to one of ordinary skill in the art to add a variable supply converter to Geis for the benefit of utilizing the power converter as a controller for the turbogenerator [see Geis Abstract].

Response to Arguments

Applicant's arguments filed 5/01/2006 have been fully considered but they are not persuasive.

Applicant argues on page 10 of remarks that Aiello's Fig. 1, 1a, and 3 are incompatible with each other because Aiello's input transformers are substantially different from the prior art. Applicant does not specify exactly how the input transformers are different; however, the examiner finds no significant difference between the transformers shown in Fig. 3 versus the prior art shown in Fig. 1. Prior art Fig. 1 only generally shows the types of connections that may be used to supply the converter, while Aiello schematically shows his preferred connections in Fig. 3. The two are fully compatible with each other because both converters are capable of using any of the well-known types of transformer connections (be it delta, wye etc.) in order to function properly.

Applicant argues on page 11 that Aiello's transformer is different than applicant's transformer because the transformer would not be divided up into segments for each power unit as described by the applicant. However, the examiner finds little or no

discernable difference between the structures shown in Aiello's Figs. 1, 3, and 8, and the limitations as recited in applicant's independent claims 20 and 21.

Applicant argues on page 11 that Aiello's power cell shown in Fig. 1a (which is prior art) cannot correspond to the power unit of claims 20 and 21 since each of those power units includes multiple cells. Again, the examiner finds little or no discernable difference between the structures shown in Aiello's Figs. 1a and 13, and the limitations as recited in applicant's independent claims 20 and 21.

Applicant argues on page 11 that Aiello's transformer 469 is part of a single power cell and was never suggested as part of a modular unit. The examiner has clarified by specifying transformers 41, 42, and 43 in Fig. 3 as the transformer in question.

Applicant argues on page 12 that no interpretation of Aiello can meet the claim limitations of claims 20 and 21; however, the examiner believes otherwise, as indicated above in the claims 20 and 21 rejections.

Applicant argues on page 13 that there is no element corresponding to the power unit. It is clearly evident from Figs. 1, 3 and 8 that one power unit is the combination of the switching cells (or applicant's power cells) A3, B3, and C3, fed by transformer 41, each switching cell provided with its own secondary winding as shown.

Applicant argues on page 14 that there is no description of providing both kinds of connections at respective sets of secondary windings of the same transformer as in the invention. Fig. 1 and 10a-h show secondary windings comprising both star and delta connections.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard V. Muralidar whose telephone number is 571-272-8933. The examiner can normally be reached on 9:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Karl D. Easthom can be reached on 571-272-1989. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RVM
8/13/2006


KARL EASTHOM
SUPERVISORY PATENT EXAMINER